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## THE PAST AND THE FUTURE OF THE MEDICAL SCIENCES IN THE UNITED STATES[1]

AT the 1919 meeting of the American Association for the Advancement of Science, held in St. Louis, the association adopted a new constitution which included among other modifications a change in the name of this section from "Physiology and Experimental Medicine" to "Medical Sciences." In the same year, the National Research Council of the United States in effecting its "permanent organization" on a peace time basis changed the name of its "Medical Division" to "Division of the Medical Sciences." Thus in a single year the term "Medicine" disappears as the substantive from the titles of what may fairly be regarded as the two most important organizations on the continent whose main function it is to further the interests of science in general and to stimulate research, to yield up its primary position to one secondary in importance to the term science. There can be no doubt but that these changed designations are indicative of a changed attitude in the United States toward medicine as a science, and it therefore seemed fitting that the first chairman of the section thus newly designated upon retiring from office should essay an analysis of the factors that seem to him to be responsible for the change, in an effort to ascertain the significance of the implied trend. An additional reason for selecting this general topic for discussion is the rather unusual and intimate insight into the conditions at present prevailing in the departments of the medical sciences in the United States which the speaker was enabled to gain through his connection with a study of the supply of assistants in pre-

[1] Address of the vice-president and chairman of Section N—Medical Sciences, American Association for the Advancement of Science, Toronto, December, 1921.

clinical departments, carried out under the auspices of the National Research Council.

The statements from the laboratories of the country collected for the purposes of that investigation have been analyzed elsewhere with a view to securing from them the information relating to the question then in hand. But they contain in addition a wealth of material bearing on the broader topics of the present status and future prospects of the medical sciences in this country which this paper proposes to discuss. From this material the speaker has drawn freely in developing certain of the phases of his subject; owing to the circumstances of its collection, though, it has not been possible always to indicate to whom credit is due. And finally, it should be added that the views to which expression is given in this address may apply best, possibly only, to the branch of science in which the speaker himself works, namely physiology, and with which he consequently has a certain degree of familiarity. He is inclined to believe, though, that they will apply to the other medical sciences also; to some rather closely, to others perhaps somewhat more remotely.

In order to gain a vantage point from which to survey the field of medical science as it has been cultivated in the United States and from which to ascertain the direction in which it is moving, it becomes necessary first to trace in a cursory way the development of the subject from its beginning down to the establishment of its modern trend. Contributions to science have been made ever since man acquired the ability to hand on his experiences with nature; but in the case of medical science, at least, such advances as were made down to the fourteenth century were upon the whole unimportant, and for the most part casual. It should be borne in mind, though, that whatever of value was then gained formed the basis upon which subsequent advances were built. Every now and then these occurred in rapid sequence through the efforts often of single individuals or of groups of individuals stimulated by an innate desire to ascertain the relation between cause and effect, and endowed with the genius to see those relations.

With the revival of learning in Italy systematic studies by the scientific method here and there began to be made of the more obvious of the natural phenomena. The structure of the human body mainly, but occasionally its functions also, both normal and abnormal, collectively then known under the name of anatomy, and the structure of the universe were amongst the first of the problems to be attacked with any degree of success. At this time, and indeed in one and the same year, there appeared the *"De revolutionibus orbus cœlestrum"* of Copernicus and the *"De corporis humani fabrica libri septem"* of Vesalius, the epoch making works in their respective fields; medical science and physical science employing in effect the same methods are here seen advancing together as they have ever since, because of their related habits of thought and their mutual helpfulness. Progress in the experimental phases of medical science, however, was slow. The faint glimmer of light in this direction that became discernible during the Renaissance, in the succeeding four centuries every now and then broke forth momentarily into a brighter flash when some keener intellect such as Harvey, Malpighi, Mayow, Boyle, Haller, Hales, Spallanzani, Hewson, Lavoisier, Wolff, Hunter, Young, Morgagni and others, gentlemen of leisure, clergymen, lawyers, physicians, rarely scientists by vocation, compelled by an inborn spirit of inquiry and working for the most part in private laboratories, made brilliant contributions to the slowly and sporadically growing accumulation of medical science.

Partly in consequence of the rapidly widening confines of knowledge, but especially as a result of the recognition of underlying differences in technical methods, a tendency to separate the functional from the structural phases began to develop, the former leading to physiology, the latter retaining the designation, anatomy. At about the same time, a distinction began to be more clearly drawn between the normal and the abnormal, both in structure and in function, and a tendency to appreciate more fully the value of organic chemistry in the study of biological phenomena became obvious; although biological chemistry came to be recognized as a distinct science at a

somewhat later period. It would seem, however, that there is no simple formula that is sufficiently general to account fully for the sequence in which the independence of the several medical sciences became established.

Toward the close of the first quarter of the last century, this sporadic and localized growth of medical science became more consistent and eventually general, though still somewhat uneven, throughout the whole of western civilization. The initiative in this new growth is attributed mainly to the influence of two men, viz., Johannes Müller, professor of anatomy and physiology at Bonn and Berlin from 1830 to 1858, and François Magendie, professor at the Collège de France from 1836 to 1855; and it was fostered by a recognition of the fact that medicine is nothing more nor less than a part of science. I do not believe, however, that I am mistaken when I maintain that in previous epochs of the history of science there have been individuals, even groups of individuals, who have employed the experimental method, and quite as successfully, to advance medicine, and who have regarded medicine in exactly the same light. It would seem, therefore, that some new and fructifying influence must at this time have been brought to bear upon such efforts as were being made toward progress. Why, we might ask in this connection, did the new growth develop more vigorously in Germany than in France? Certainly not because the Germany of that time occupied an advanced position in science or in medicine; for, as a matter of fact, medically, Germany then stood at the foot of the world. Nor was it due to any superiority of Müller over Magendie as an exponent of the experimental method in medicine; for it is now generally conceded, excepting, perhaps, in Germany, that the latter made "the experimental method the corner stone of normal and pathological physiology and pharmacology" (Welch) and that "his method of work and his points of view are the ones that were subsequently adopted in physiology" (Howell). Furthermore, the progress of science up to this period proves that it was not any superior qualities of the Teutonic mind that determined Germany's part in the new growth of science. Rather it would seem that the development was more rapid, more continuous and more even there than elsewhere, unquestionably because it was an *organized* development. The state early recognized the advantages to be gained by leading the world in science, and, by establishing and supporting, generously for those times, laboratories of the medical sciences in the universities, which it owned and controlled, by offering to their medical schools the free use of their state owned hospitals for teaching and investigation, and by exercising a liberal and *laissez faire* policy in their dealings with men of science, the conditions were supplied which not alone were conducive to scientific investigation but also attracted into university careers those best able to contribute by investigation to the advance of medicine.

The world's history affords numerous examples of a comparable influence of far-seeing monarchical aid upon the advance of science. The first gleam of organized science in the world (Wells) shone from the Lyceum at Athens where a liberal endowment by Alexander the Great put Aristotle in a position to make a comprehensive collection of material to serve as a basis of his natural history. Again, the professors and fellows of the Museum at Alexandria were appointed and paid by the Ptolemys (Wells) and when their patronage ceased its scientific energies became extinct. And into Russia anatomy, then practically the comprehensive medical science, was forced by the arbitrary will of Peter the Great when he founded a medico-surgical school at Petrograd and left plans for the establishment of the Academy of Science where anatomy has since been cultivated, under very satisfactory conditions, by some of the greatest of its students (Bardeen).

Surrounded by the very best of working conditions, with an almost virgin field to work in, Germany needed only the time necessary to imbue its student body with the spirit and the possibilities in order to gain the ascendency in medical science. Workshops for different sets of problems, physiological, biochemical, pathological, pharmacological, hygienic, with professional workers in charge, gradually re-

placed the private laboratories that were usually conducted merely to satisfy an avocation. The pupils of Müller and their contemporaries, in charge of these laboratories, soon attracted to them the attention of the world, and medical students flocked to work in them as they once had to Italy during the revival there.

Though the spread of modern scientific medicine for the most part can thus be traced either directly or indirectly from Germany, sight should not be lost of the fact that in all of the more enlightened countries of the world the spark of independent genius has ever continued to add by its own methods to the realm of knowledge. There never has been a more brilliant worker in physiology than Claude Bernard, the pupil and successor of Magendie; and 'the story of the rapid sequence of Pasteur's brilliant discoveries in science ever of crucial importance and establishing a new principle, has . . . . . no parallel in biology, or, for that matter, any other science" (Pearce). Furthermore, though the start was made in Germany, in some localities the transplanted method has led to a growth that has been quite as splendid as in the land of its original cultivation. This is true, for example, of the development of physiology in England (Hopkins).

In the United States, with which the rest of this paper deals, a beginning was made in medical science before the dawn of the classical period of the modern development in Germany, and the start was quite auspicious. Just before the American Revolution medical schools began to be founded in connection with universities; with the College of Philadelphia in 1765; with King's College in 1768; and somewhat later with Harvard, 1783; Dartmouth, 1798, Yale, 1810, and Transylvania, 1817. The model of these schools was the medical department of the University of Edinburgh, which in turn represented a development of the idea of the great Italian universities, handed down through the Dutch university of Leyden (Welch).

These schools were founded by men who had received their training mainly in the proprietary schools of London and in the University of Edinburgh. Of the medical sciences descriptive anatomy alone was cultivated. Apparently the contact which many of the teachers in these schools had had with that master of experimentation, John Hunter, and with Charles Bell failed to transmit the spark; for they contributed nothing to the development of experimental medicine. The reason for this seems to have been that whatever of the scientific spirit these pioneer university schools may have had was soon crushed out through competition with the great crop of private schools of anatomy and of proprietary schools of medicine that grew up about them. In the absence of any guiding spirit practically all schools became commercial enterprises, conducted rather for the professional reputation and pecuniary benefit of their faculties than with a view to training good physicians or to advancing the science of medicine. There were, to be sure, exceptions to this rule. Some proprietary schools were founded by high minded men and were maintained for the purpose of supplying well trained physicians to a rapidly expanding country which was neither rich enough nor settled enough to support university schools properly so called. An outstanding example was the so-called Medical Fund Society, the holding corporation of the St. Louis Medical College, now the Washington University School of Medicine, through whose devotion and self sacrifice the St. Louis Medical College eventually came to be supplied with a permanent endowment, and was enabled to become one of the first medical schools west of the Atlantic seaboard to establish a scientific laboratory (under W. T. Porter in 1886). But even the more ethical of these schools, dependent, as they were, almost entirely upon fees from students, failed to supply the elements that are necessary to lead any but a self sacrificing genius to interest himself in and devote himself to medical science.

In consequence of these conditions, following the American Revolution and for a period of almost 100 years medical science in the United States rather receded than advanced. Excepting certain individual and for the most part casual contributions, such, for example, as those by Beaumont, made in the back woods

and despite every kind of obstacle, and those by S. Weir Mitchell, both entirely American trained, nothing was accomplished toward the development of the science. It should be added, though, that both Beaumont and Mitchell were influenced to some extent by the progress in Europe. Interesting proof of this is found in the marginal annotations in Beaumont's private copy of Magendie's "Summary of Physiology," now a part of the Beaumont collection in the library of the Washington University School of Medicine.

It is clear, then, that the more enlightened of the American profession were not unfamiliar with European progress in medical science. Many of them indeed had been abroad, attracted mainly to the France of the early nineteenth century by her prowess in clinical medicine. But, with the exception of Spain and possibly one or two of the smaller European states, the United States has been the slowest of the enlightened nations of the world to participate in the scientific productivity of the modern era. For this tardiness a number of factors seem to have been responsible. One of them, the main one, viz., the low estate of medical education of the time, has been mentioned. It is possible that preoccupation with the affairs of a rapidly expanding country, which gave little opportunity for leisure, and the distractions centering around the attempts to settle the institution of slavery, culminating in the Civil War just about at the time the peak of the progress in Europe was being reached, also were factors. The influence of the Civil War in retarding progress is indicated by the history of the first laboratory for experimental medical research to be established on this side of the water. Henry P. Bowditch had just been graduated from Harvard College when the Civil War broke out. Upon resigning from the army at the close of the war he took up the study of medicine, graduating in 1868, and then went abroad, where he worked in the laboratory of Claude Bernard, but especially in that of Carl Ludwig. Immediately upon his return to this country in 1871 he created the physiological laboratory at Harvard. In the same year, it might be added, Harvard instituted laboratory instruction, though not research, in histology and pathology.

Five years elapsed before any further progress in this direction was made. Then, in 1876, through the wise use of an opportunity to make a wholly new start, there was established the first institution in the country, the Johns Hopkins University, to raise productive scholarship in all of its departments to the plane it occupied in European universities. Newell Martin, Michael Foster's assistant at Cambridge, primarily a physiologist, was called from England to fill the chair in biology. From this laboratory and from the laboratory established at Harvard a considerable number of physiologists and experimental biologists have since gone forth, and through the incentive of these two institutions physiological laboratories were established in quick succession in the more progressive of the medical schools of the country.

Without running through the gamut of the laboratories of the medical sciences that were then established, it may be stated merely that in the period extending from the introduction of the scientific spirit into the study of medicine at Harvard in 1871 down to the beginning of the present century the more advanced of the medical schools and especially those connected with universities voluntarily filled their chairs with men who were drawn into the work by the spirit of research and who looked forward hopefully to the future of their profession in their country. To this natural development of the medical sciences there has more recently been added a forced and rapid growth, the result of propaganda for the elevation of standards conducted by the Council of Medical Education of the American Medical Association, by the Association of American Medical Colleges, and by the General Education Board through their reports on the status of medical education made by Flexner, and through the elevation by State Boards of Medical Examiners of the requirements for admission to practice. Along with this development of science departments, there has occurred a great increase of interest in what has come to be called the science of clinical medicine, which Meltzer, its first exponent in

the United States, has defined as the "science of the natural history of diseases, their physiology and the pharmacology." Contributions to this phase of medicine until quite recently had been made almost solely by clinicians in such time as they could snatch from teaching and practice. Through the organization of clinical departments, in some schools, upon the same basis as the preclinical departments there is now an opportunity open to men so inclined to devote themselves wholly to the advancement of the science of clinical medicine. Other recent developments have consisted in the establishment of research laboratories in connection with a few of the better hospitals and in the foundation of medical research institutions both in connection with and independent of universities.

This tremendous growth in the number of full time laboratories of medical science has necessitated a corresponding increase in the number of men devoting themselves to the subject. I am sure that something of interest would come of a careful study of the rate with which this increase has occurred; but the information necessary to accomplish it satisfactorily is not at hand, and even if it were, far more time would be required to make it than I have had at my disposal. But I do happen to have some data bearing on the rate of increase in the membership of the American Physiological Society. Starting in 1887 with a charter membership of 28, the membership in 1896 amounted to only 68, but by 1921 had increased to 292. If to this be added the membership of the societies that have grown out of the Physiological Society, namely the societies for biochemistry, formed in 1906, for pharmacology in 1908, and for experimental pathology in 1913, the total membership excluding duplicates now amounts to 469. These figures give some idea of the rapidity of the development during the present century. In order to gain some idea of the number of men now devoting themselves to the science of medicine, I have had an estimate made of the medical scientists exclusive of those following "medicine" and "surgery" listed in American Men of Science; conservatively the total is in the vicinity of 1,200. And in order to gain some notion of the number of these connected with medical schools supporting full time laboratory departments it has been assumed, again conservatively, that in each of the 68 Class A schools there are 10 full time men devoting themselves to medical science, or a total of 680.

The first journal to be published in America to serve primarily as an outlet for research in the medical sciences was the *Journal of Morphology,* which began its career in 1887; and the first journal devoted to experimental medical science, the *Journal of Experimental Medicine,* appeared in 1896. Then to care for the increase in the volume of research conducted by the greatly augmented personnel came in fairly rapid succession special journals devoted to physiology, 1898, to anatomy, 1900, to biochemistry, 1905, to pharmacology, 1907, etc., etc., so that now there are some 17 titles devoted practically exclusively to the medical sciences. In the same period there has also been an increase in the number of journals devoted to clinical science. Owing, however, to the difficulty of distinguishing between those maintaining a high scientific standard and those less particular in the quality of the papers accepted for publication, it is difficult to estimate accurately the development in this direction.

The increase in journal titles does not exactly parallel the increase in the volume of published work; for there has been in some cases an increase in the number of volumes issued per year and often also an increase in the size of the volume. Furthermore, prior to the publication of American science journals a certain number of scientific papers which would have found a place in them appeared in the clinical journals, a certain number also were sent to foreign periodicals for publication. However this may be, a rough estimate of the volume of work now published may be formed merely by counting the number of volumes issued by the American journal, exclusive of the clinical journals, during the year 1920. This totalled 35.

Viewed in the abstract, the tremendous increase in the number of work shops of the medical sciences, in the band of workers and in the volume of their published work that has

occurred in the United States during the course of the fifty years that have elapsed since cognizance was first taken on this side of the water of the existence of a science of medicine, might be regarded by some as sufficient grounds for a feeling of complacency on our part. But after all, such matters are largely relative; accomplishment in these directions can be gauged only by comparison with what has been and is being done elsewhere. Before assuming a self-satisfied attitude it would be well to make a few inquiries: "Are we doing as much work in medical science as the number of men engaged ought to accomplish?" "Does the United States occupy in the realm of medical science the position it now holds in the political and commercial world?" "Are we doing as much as a country should which stands first in point of wealth and first amongst the western nations, with the exception of disorganized Russia, in point of population?" But above all, "How does the quality of the work we are doing measure up with that which is being done elsewhere?" In a material way the United States is one of the first countries in the world; what is her position in the realm of medical science?

Satisfactory answers to these questions can be obtained only by providing some standard for comparison. Without making any apologies, and for reasons which will become clear as we proceed, we propose to compare our accomplishment with that of Germany. It has been stated that there are in the United States at the present time at least twelve hundred men devoting themselves to preclinical science. Comparable data relative to Germany are not available. We do know, however, that in 1921 in her 22 medical schools there was a total of 312 full time men in the departments of the preclinical sciences, to which for our purposes might be added the number of full time preclinical instructors in the three medical schools of German Austria, bringing the total to 387 (compiled from Minerva). It was stated above that 35 volumes of medical research are now published annually in the United States in 17 journals. This is the product of the labor of approximately 1,200 men, some 680 of whom are connected with medical schools. Germany publishes 44 journals of similar scope and comparable as regards standards with the 17 of the United States, the total of volumes amounting to 72. There is no convenient way of ascertaining the number of professional men of science contributing to the German journals for the reason that they cater not alone to Germany and to Austria but also, to a certain extent, to some of the other European states that have no media for their own papers. It seems rather unlikely, though, in view of the ratio of the number of university instructors in Germany to the number of university instructors in the United States as computed above, that the number of professional contributors to German periodicals exceeds the number of professional scientists in the United States.

But even if it were true that the volume of scientific work in the United States has increased to the point of equaling that produced by Germans, it is not the amount of productive scholarship that counts, but its quality. It is just here that judgment becomes difficult. Individual opinion on a question of comparative merit is worth but little. Of somewhat greater value is the judgment of world courts, but even these are not infallible judges. Bearing this in mind, let us review the findings of foreign academies and of the Nobel Prize Commission. In 1909 Pickering found that of the 87 scientific men who were members of at least two foreign academies only 6 were American as compared with 17 from Prussia, 13 from England and 12 from France. To be sure this exhibit is of the fruit of a generation ago; it is possible, furthermore, that this disproportion no longer obtains. Indeed, news reports would seem to indicate that during the past two or three years a considerable number of Americans have been the recipients of foreign honors. While to a certain degree this new movement may be the result of a tardy recognition of scientific achievement, there is no doubt but that diplomacy also enters as a factor. So even if present figures should be found to be less disproportionate, it might be safer to accept the decision of the earlier ratio than that which a

new statistical study might reveal. These difficulties do not apply, not at least in the same degree, in the case of the awards by the Nobel Prize Commission. There have been in all 18 awards of the prize for eminence in medical science. Four times it has gone to Germany and once it has come to America. And it may not be entirely irrelevant to our theme to add that the recipient in America is foreign born and foreign trained.

Accepting this verdict of the world on the quality of medical research in the United States it behooves us to search for the causes of our shortcomings in the hope that a way to improvement may be found. The first thought the situation raises is that our failure to measure up favorably in productive scholarship with the best that has been accomplished elsewhere possibly is to be ascribed to the recentness of our entrance into the field. This is scarcely possible. Germany required the time of but one generation to acquire her pace. We are now well along in the second generation, almost indeed, at the beginning of the third, and while, as has been said, we have developed more workshops and more posts than now exist in Germany, not alone have we not caught up with her, but she seems still to be gaining on us, though perhaps at a diminishing rate. By way of illustration we need to refer only to the 19 new journals of medical sciences which she has launched in the last 20 years, in comparison with our 15.

No, the difference in our relative positions continues to exist not because of the tardiness of the manifestation of our interest in medical science, but for several reasons of which the first consists in our failure as yet to provide sufficiently or sufficiently generally, the ideal academic relations both material and personal which the German government could and did supply from the very beginning, and which, as has been pointed out, made possible her phenomenal start. To further embarrass the healthy development of medical science in the United States new conditions have developed which I would not presume to mention were it not for the importance attributed to them in so many of the statements submitted to the committee on pre-clinical assistants. Due to the rapid, in part forced, spread of the medical sciences through the professional schools of the country, for which but few could make adequate provision; due further, to a depreciation in the purchasing power of money, more rapid than the advancing scale of emoluments, which were rather meager even at the beginning, aggravated by a concomitant elevation of the general scale of living permitted by industrial prosperity; and due to the establishment of university clinical departments upon endowments permitting a more adequate support than is possible in any preclinical department; due to all of these and to other factors to be mentioned later, it is becoming increasingly difficult for preclinical departments to secure recruits of any kind, let alone recruits who have given evidence, or even promise, of being able to make noteworthy contributions to the advancement of science. In some quarters the view is held that these conditions are merely temporary and consequent upon the war. As a matter of fact, however, they were beginning to make themselves felt years before, and not alone in this country but in Germany even. In 1911 Barker writes, "when the financial rewards of most of the lines in medicine are distinctly alluring, only a vein of eccentricity or idealism can induce a young man of ability to enter a career which assures a comfortable living for but a few fortunate leaders"; while Abraham Flexner in 1912 states that "assistants are scarcer (in Germany) than formerly when the deprivations attendant on a scientific career were less deterrent than they now appear to be." The investigation carried out by the National Research Council in 1920 demonstrated unmistakably that the scientists themselves now regard the situation just as did the clinician and the educator ten years ago. I have been told that after reading the report of the National Research Council a certain financier, presumably a university trustee, concluded from the statements of departmental heads quoted therein that university men had lost their idealism. Be this as it may, it is futile to deny that scientific men are any less, or

ever have been any less, under the influence of the incentives which spur on human beings in general to give of the best that is in them. These incentives are the opportunity for achievement—achievement of worldly goods, achievement of position or achievement of fame. Under any circumstances there must be provided for men entering scientific careers an opportunity to gain by their own efforts the prerogatives and comforts which now can be acquired in other walks of life by any one of similar attainments who meets with a fair degree of success. Position in the scientific world can be attained only through scientific accomplishment and, innate ability aside, its attainment depends in large degree upon the provision of certain conditions, amongst which may be mentioned freedom of action, opportunities for research and often a certain, though not excessive, contact with students. It may not be superfluous to state that medical scientists have been known to decline at great financial sacrifice proffers from institutions of excellent repute but which were not in a position to supply the last only of the conditions just outlined. It can not be denied, however, that the financial incentive seems to be gaining in importance. And the reason seems to be that in times like the present, when fundamental discoveries are rather infrequently made and scientific achievement therefore is relatively slow, the hope of gaining distinction as an investigator alone is not sufficiently strong to induce assistants to put up with "the deprivations attendant on a scientific career." It is as true now as when Cannon stated it in 1911, that "the satisfactions of a life devoted to investigation like the satisfactions of other careers, arise from a profitable use of one's powers."

The recent movement to increase the support of clinical departments which in some places includes putting them on a full university basis, has had the effect of adding still further to the difficulty of the preclinical departments in securing assistants. In the physiological, the chemical and the biological divisions of the clinics men who desire them are given opportunities to devote themselves to any branch of medical science and at salaries usually in excess of those paid preclinical investigators in the same stage of advancement. These posts do not, as do the preclinical posts, preclude contact with clinical medicine; it therefore happens that incumbents in the former may at one and the same time, fit themselves for university careers or to step out into practice. It is obvious under these circumstances that such departments rather than the preclinical departments will have first choice of any such men as may wish to devote themselves to experimental medicine. The so-called full time movement unquestionably is a step in the right direction. But unless the disparity in compensation be removed, and unless, in general, appointments to the science posts in the clinical departments be conditioned, as they logically should, upon an apprenticeship in the preclinical department of the subject which later is to have the candidate's attention in the clinic, the fundamental departments will be ruined and will drag down clinical science with them.

This brings us to the last of the difficulties we desire to discuss which stand in the way of a healthy development of medical science in the United States. It is obvious that in so far as departments are inadequately provided for and that in so far as able men cannot be induced to take up preclinical science as a career, these conditions in turn will stand in the way of securing strong men. "If a department has a professor, an assistant professor and several instructors who are well trained, active investigators, they by contact with the students are able to interest them in investigation and thus increase their chances of becoming permanently attached to investigation as a pursuit. Just because we have an inadequate or ill qualified personnel we continue to have such a personnel."

It seems clear then that the United States is not accomplishing all that it should toward the advancement of medical science; that in part this is due to the absence of that complete fusion of hospital with the research laboratory, that permits the free transfer of problems from laboratory to hospital and from

hospital to laboratory, but in larger part to a failure to provide in sufficient measure those conditions that serve to attract able thinkers and men of action to the work. One can not in this connection avoid asking as to whether or not the American mind really possesses the qualities that make for scientific acumen. There can be no question but that it does. If proof of this is needed it is furnished by the development of astronomy in the United States. Astronomy is a science that appeals strongly to the popular mind and on that account early won the support of American philanthropies. That this confidence was not misplaced is indicated by Pickering's figures which show that of the six American men of science who, as has been said, are members of two or more foreign scientific academies, three, or one-half the number, are astronomers. If Americans can become prominent in astronomy, why not in medical science also?

In explanation of the present difficulties it has been suggested that we are not providing a suitable course of training for those who otherwise are adapted to a career in medical science. This is entirely aside from the subject discussed above of the quality of present day teachers. The training calculated to give the best preparation for the pursuit of medical science is so different for the several sciences that within the limits of this paper it will be possible to discuss the subject in general terms only. In preparation for any of the sciences, with the possible exception of pathology, the training may be either medical or philosophical. In most of our better universities, either of these preparations may be and has been pursued, with the result that there are today in the chairs of our more prominent laboratories of physiology, for example, almost as many doctors of philosophy as doctors of medicine. There is nothing obvious in the careers of the two groups thus differently trained that leads to the conclusion that one set has had any decided advantage over the other. To be sure, those entering the field of preclinical science through the medical gateway, are less apt to have received instruction in physical chemistry or in advanced mathematics and physics, subjects which are helpful in all types of experimental work, especially in physiology. But at the risk of making a trite remark, it may be said that training does not end upon the receipt of a degree. All of us in the course of our careers have seen young men of talent rise to the occasion and acquire the mathematics or the physics, or what not, that happened to be necessary to provide them with the power to solve the problems of their choosing. It seems obvious, therefore, that it is more the quality of the brain than any particular training that makes for success in investigation.

In connection with the establishment of research laboratories for physiology, chemistry, biology, etc., manned by full time investigators, in direct connection with the clinics, the question of the advisability of a division of labor has arisen. At one extreme it has been maintained (Cole) that these clinical laboratories must be complete in every detail, and absolutely independent of the departments of the "contributing sciences"—"anatomy, physiology and pharmacology" though if necessary "to give advice . . . . specialists in the various branches of science can always be *employed* (italics mine) . . . . to give advice"; while at the other extreme are those (Henderson) who feel that these clinical laboratories should be in direct charge of the fundamental departments after which they are named. It would seem, however, that the best policy to pursue is not to adopt any particular system, but merely to provide equal opportunities for the two groups of workers, one interested primarily in the fundaments, the other in their clinical applications. Neither group should nor would be debarred from poaching on the other's domains; there is no devotee to pure science who knowingly would fail to at least point out any practical application of the results of his investigations; neither should a clinical scientist be frowned upon if perchance his research should lead him into the realm of general principles. But in general, and in the interests of a helpful division of labor, a full time surgeon, for instance, would be expected to devote himself to surgery, per-

fecting himself first in the technique of diagnosis and treatment of surgical conditions and then, in his laboratory, concerning himself with the development of methods of surgical diagnosis and treatment. In other words, the surgeon ordinarily devotes himself to surgery, just as the physiologist ordinarily devotes himself to physiology. When border line work is undertaken there should be provided an opportunity for cooperation between departments either by means of direct help or through advice.

In the development of our theme it has been furthest from our intention to give the impression that the effort made in the United States to contribute to medical science has been futile; as a matter of fact, we are now accomplishing as much as a great many other countries. But it is clear that we are not doing as much as we should and our purpose has been to ascertain the causes of our backwardness in the hope of pointing the way to their removal. In Germany, it has been seen, the ascendancy was gained through wise action of a paternal form of government in supplying the conditions that are most conducive to securing *men*. In a democracy, such as the United States, the same end can be gained only by the much slower process of education. Not alone is it necessary to obtain the interest of men capable of supplying brains for the development of medical science, it is equally necessary to educate the enlightened public up to the point of understanding that just as in the case of astronomy, or of physics, or of chemistry, it is only by the diligent employment of the scientific method that progress is possible; that by that method alone will an understanding ever be gained of the manner in which the human body functions in health and disease. The adoption of the designation "Medical Science" for this division of the American Association and for what formerly was the "Medical Division" of the National Research Council is taken to indicate that the value of science in medicine is coming to be appreciated by scientific men and presages a recognition of its worth by the enlightened public at, let us hope, not too remote a date. When that has come about, and not until then, will medical science in the United States come into its own.

But is the goal still worth fighting for? Is it possible, to quote Herter, that the "golden nuggets that are near the surface of things have been for the most part discovered?" In a general sense this figure unquestionably represents conditions as they now are. It is incomplete, however, in that it applies only to the working of claims already staked out, and fails to allow for the possibility that venturesome spirits from time to time may succeed in opening up new territories in which surface mining may again bring forth rich yields. And it fails to allow for the possibility of an improvement in machinery which may make deep mining as profitable as placer mining. Great as is the headway that has been made, it does not require a very intimate acquaintance with medicine to realize that such unopened domains still exist. But whatever the future may have in store for us we must, I think, in the interests of progress, if for no other reason, maintain that a way will be found by which to explore them. One has only to recall in this connection the remarkable development of the sciences of bacteriology and immunology that has occurred in a little over one generation; or, to go outside of medicine, to consider the revelations in radio activity in our own time and the remarkable influence they have had upon our fundamental conceptions of matter and force, conceptions which have as yet scarcely made themselves felt in medicine, in order to realize that there still must be plenty of opportunity for revelations in medical science if only it could be recruited with master minds capable of reading the signs which still elude us. If the United States is to supply her share of the progress that is to come a way will have to be found of bringing into the field of medical science the talents which, in the opinion of those best able to judge, are most likely to see the light.

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## SUBSIDY FUNDS FOR MATHEMATICAL PROJECTS[1]

HERETOFORE little attention has been given to the question of subsidy funds for mathematical projects, quite unlike the case with some of the more spectacular sciences. The presumption is prevalent among non-mathematicians that mathematics is an organized and crystallized body of necessary conclusions drawn some decades or centuries ago from certain intuitional concepts of number and form, and that no special provision for equipment or funds is necessary for carrying on mathematical work.

On the contrary, it is the purpose of this paper to show that mathematics, as a live and active subject, is in need of funds for its promulgation as much as any other science. For example, the following needs may be mentioned:

(1) A revolving book fund for the publication of mathematical treatises. It has not been possible, on account of economic conditions, for an author to secure the publication of a mathematical treatise by one of the commercial publishing houses for several years past and, apparently, will not be possible for some time to come. It is well known that such treatises of worthy character are awaiting publication, but that not even second or subsequent volumes will be accepted by publishing houses which have already printed the preceding volumes. The only remedy for this most unfortunate situation is a subsidy fund which may be drawn upon to guarantee the cost of publication, such guaranty to be returned, in whole or in part, to the fund whenever the sales may so warrant. A lump sum of $25,000 could be wisely used at once for this purpose and should be handled through the American Mathematical Society.

(2) A mathematical dictionary in English. There is no mathematical dictionary in any language that is even approximately up to date. Students and workers of all kinds in mathematics, and in fields in any way related to mathematics, should have the benefit of the best dictionary in the English language that can be made. The Mathematical Association of America has already considered this matter in great detail, even to the careful estimating of the scope and size of such a publication and of the cost of its preparation. A lump sum of $100,000, or of $20,000 per year for five years, will be needed for the preparation of the manuscript. Such a work would be monumental in character and would insure great honor to any donor.

(3) Publication of a historical journal in English. As is well known, the only mathematical journal in the historical field, the *Bibliotheca Mathematica*, has been entirely suspended on account of economic conditions. Its venerable editor, Mr. G. Enestrom, has appealed to friends in this country to assist in continuing this journal as an American publication. The *American Mathematical Monthly* has recently made a serious effort to secure funds for combining the *Bibliotheca* with the *Monthly*, but so far without success. A fund of $2,000 per year, or an endowment of $40,000 would be needed in order to appropriately perpetuate the long and honorable record of this journal, and to do this would not only render assistance in a most worthy cause, but would bring honor to America and to any donor who should make it possible.

(4) Enlargement of our mathematical research journals. It is a distressing fact that all of our mathematical research journals are in crying need of more space for the publication of scores of articles already accepted. The *American Journal of Mathematics*, the *Annals of Mathematics*, and the *Transactions of the American Mathematical Society* should all be brought up to at least five hundred pages per volume and the latter could well be extended to six hundred pages. But this could not be done at present, and probably not for a long time to come, without a subsidy fund of at least $2,500 a year or an endowment of $50,000. In addition to this space, the *Transactions* would need a whole extra volume, at a cost of about $4,000, in order to catch up with available worthy contributions.

[1] A paper presented to the joint meeting of the American Mathematical Society and the Mathematical Association of America at Toronto, Ontario, December 29, 1921.

(5) Expansion of the *American Mathematical Monthly.* It has long been the hope of those in charge of the *American Mathematical Monthly* that it might become possible to publish two extra numbers (in July and August of each year) to be devoted entirely to expository and historical articles of an elementary character suited to the needs of students and teachers of mathematics in the normal schools and colleges throughout the country. This need is great and the service thus rendered would be of inestimable value. The regular volume of the *Monthly* should also be expanded by eighty pages in order to handle matter pressing for publication. For these purposes an annual subsidy of $2,000 would be needed, or an endowment of $40,000.

(6) Publication of mathematical monographs. A subsidy fund has recently been donated to the Mathematical Association of America by Mrs. Mary Hegeler Carus, as trustee of the Edward C. Hegeler Trust Fund, for the purpose of publishing a series of mathematical monographs which shall provide in convenient and readable form, and at low cost, expository presentations of all the great subjects in pure and applied mathematics. This gift is in the form of an annual subsidy of $1,200 for five years with the promise of capitalizing this income in perpetuity if the project proves successful. Such an endowment would need to be $24,000 on a five per cent. basis.

(7) A mathematical abstract journal. A journal in the English language of abstracts of mathematical publications has long been needed and became very urgent during and subsequent to the world war, when foreign abstract journals were suspended or were hopelessly in arrears. Such a journal of the high character and efficiency contemplated by the committee of the National Research Council and the American Mathematical Society could only be produced and maintained with a liberal subsidy—at least $15,000 annually or with an endowment of $300,000.

(8) A bibliography of bibliographies in mathematics. The National Research Council has proposed as one aid to efficiency in scientific work to publish a bibliography of bibliographies in each of the various sciences, which shall combine in one volume all the bibliographies obtainable in a given science whether published hitherto or not. The council will bear the cost of publication and clerical expense, but the work involved in preparation of the manuscript will be extensive and should be covered by a lump sum of $5,000.

(9) Prizes and research fellowships. Something seems to be wrong when a poem or a short story may bring its author adequate financial reward, while the author of a mathematical article of the highest merit, on which he may have spent weeks or months, not only receives no financial return but actually has to pay cash for a few reprints. The only means apparently available to offset this injustice is through prizes and fellowships of liberal value. One bequest of $10,000 and one or two small funds for prizes (none of which are operative as yet) constitute the sum total of effort to date in this country. An annual fund of $25,000 or an endowment of $500,000 would be only a fair estimate of the need in this line and such an annual expenditure could be used to the utmost advantage with the greatest degree of justice to the workers in the field of mathematics. Fortunately some farsighted and loyal individuals are thinking of these things and are contemplating liberal provisions in wills toward this end. One such will is already definitely known to be made.

(10) Honorary stipends for executive officers. Time was in most scientific societies when one or two permanent executive officers worked like slaves for the upbuilding of these organizations, with no financial return and sometimes even without adequate clerical assistance. Those days of pioneering should be gone forever. In some societies, the membership is large enough, or includes those with large incomes outside the teaching profession, so that the annual dues may be made adequate to cover salaries to their executive officers; but those societies whose members are almost entirely teachers in the universities and small colleges cannot raise their dues beyond certain maximum amounts without shutting out large numbers to whom the organizations are of the utmost value. The only other alternatives seem to be either to continue the old pioneer methods or else to secure adequate subsidy funds with which to give these hard worked permanent

officers respectable honorary stipends. In the American Mathematical Society and the Mathematical Association of America there are four such officers to whom honorary stipends of at least $1,000 each should be given annually. For this purpose an endowment of $80,000 is needed. In this case again farsighted and loyal individuals are contemplating bequests, and one or two such wills with liberal provisions are known to be already made. Also a special gift toward this end has just been promised to the association for the coming year.

It will be found that the totals of the above ten items, as estimated, are as follows: For lump sums $134,000; and for annual subsidies $51,700, or, if capitalized at five per cent., an endowment of $1,034,000. As stated under (6) the provision for mathematical monographs is already made, and under (9) and (10) beginnings have been made by bequests provided for in wills or by special cash gifts. Also in connection with (2) it should be said that the proposition is under favorable consideration by a prospective donor. A donation of this magnitude would, indeed, be a monument worthy of great honor to the donor, and would render a service of untold value to the cause of education. The same may be said in varying degrees of all the items enumerated. It is believed that when information concerning these needs becomes sufficiently widespread there will be liberal responses in supplying the funds.[1]

[1] As this article goes to the printer a donor offers to provide the items of $4,000 mentioned in (4). Also a report in SCIENCE for January 13 of grants made by the Heckscher Research Foundation contains three items amounting to $2,600 for mathematics. Possibly this latter amount is the one quoted in the same issue of SCIENCE (page 52) where grants for research in twelve sciences range from $352,000 for biology down to $2,600 for mathematics. The compiler seems not surprised that "mathematics brings up the rear," since he says that "it would probably appear to most of us to be the subject farthest removed from practical interests." His surprise will doubtless be great when he contemplates a proposal for a million dollar endowment fund for mathematics.

In this connection, attention may be called to the fact that an important and urgent need of mathematics has already been recognized and met by the General Education Board of the Rockefeller Foundation in financing the work of the National Committee on Mathematical Requirements, a committee working under the auspices of the Mathematical Association of America. This work has extended over a period of three years and the funds supplied will total over $65,000 when the exhaustive report of the committee is published in a volume of five or six hundred pages.

H. E. SLAUGHT

CHICAGO, JANUARY 2, 1922

## SCIENTIFIC EVENTS

### BRITISH RESEARCH ON CEMENT

IN order to discover some means of increasing and cheapening the supply of Portland cement, experiments are being made by a panel of experts associated with the British Engineering Standards Association. The object of the research is to ascertain whether cement made from blast-furnace slag can not be made according to a recognized specification which would enable it to be used for work in which Portland cement, manufactured according to the British standard specification, has hitherto been employed.

Mr. H. O. Weller, of the Department of Scientific and Industrial Research, who is a member of the panel, explains in the London *Times* that the British standard specification for Portland cement is recognized all over the world, and has done more than anything else to make Portland cement recognized as a safe material to use. But it is beginning to be recognized that the specification is rather too narrow, and that there is need for a standard specification for iron Portland cement—*i. e.*, cement to which a small portion of blast-furnace slag has been added after clinkering. Cement of this character was first tested in Germany in 1902, and by decree of the Prussian Ministry of Public Works, in 1909, was sanctioned for use in the erection of German public buildings. This cement has come into England in fairly large quantities in recent

years. By all the recognized physical and chemical tests this cement passes the British standard specification, but in respect of manufacture it would be barred because slag has been added to it after clinkering. In Scotland a form of this cement has been made for the past 11 years called Coltness Portland cement.

In addition to increasing sources of supply, the Department of Scientific and Industrial Research is making inquiries into the question of the more economical working of processes which have become traditional, with a view to spreading the knowledge thus gained. There is an inquiry at present going on into the economical use of fuel in the burning of bricks. The greatest experts in the country at present find themselves at a loss to state exactly the total quantities of coal needed to burn bricks, and the practice varies most illogically in different brickfields.

Another inquiry is being conducted into the question of the gas-firing of kilns. This method of firing is in use in the potteries for firing clay goods, and it has been used in Scotland for the past 40 years for burning fire-bricks. But the object of the present inquiry is to ascertain whether it can be used for firing ordinary bricks. An expert investigator is being sent over England, Belgium, Germany, and the United States of America to collect the latest data.

## THE GORGAS MEMORIAL INSTITUTE

As has been noted in Science, Dr. Richard P. Strong, head of the Harvard School of Tropical Medicine, has been appointed scientific director of the Gorgas Memorial Institute which will be established at Panama for the study of tropical diseases. Dr. Strong will continue his connection with the Harvard School.

The *Harvard Alumni Bulletin* states that the Gorgas Memorial will constitute a tropical station for the Harvard School of Tropical Medicine and for other medical schools. The work in the laboratories at Panama will be separated into four divisions: 1, bacteriology and pathology; 2, protozoology and helminthology; 3, entomology; 4, biological chemistry and pharmacology.

There will be intimate association and cooperation between the Gorgas Memorial Institute and the Santo Tomas and Ancon Hospitals and the Palo Saco Leper Asylum, and the patients in these institutions will be available for observation and study. Venomous animals, poisonous plants, tropical climatology, and the biological effects of sunlight, will also receive attention in the work of the institute.

Provision will be made for advanced instruction in tropical medicine and hygiene of a limited number of properly-qualified graduates of recognized medical schools. A limited number of advanced students will also be admitted for special investigation upon tropical diseases and their prevention.

Properly-qualified volunteer workers will also be received and the privileges of the institute will be extended and a special effort made to attract experienced investigators from scientific institutions in different parts of the world, to carry on researches which can particularly favorably be conducted in a tropical country. It is especially hoped that members of scientific faculties will avail themselves of this opportunity during their sabbatical years or other periods of university leave.

The larger part of the research work of the institute will be carried out in the laboratories in Panama, but it is also contemplated that from time to time field expeditions will be sent to other portions of the tropics for the solution of special problems in connection with the diseases of men or animals.

## THE TEACHING OF EVOLUTION IN THE KENTUCKY SCHOOLS

A bill has been introduced into the Kentucky legislature forbidding the use of textbooks in the public schools in which the doctrine of evolution is taught. The movement is said to have been forwarded by lectures in the state by Mr. William Jennings Bryan. A number of telegrams have been addressed to Dr. Frank L. McVey, president of the University of Kentucky, among which are the following:

Cannot believe that any American legislature can be induced to prohibit the teaching in public schools of evolution or of any other scientific

hypothesis of proven value.—Charles W. Eliot, president emeritus of Harvard University.

Should regard bill such as you suggest certain to make Kentucky the laughing stock of the world. To prohibit the scientific teaching of the facts of evolution would involve adopting intellectual attitude of the twelfth century. It is a proposition which could not be seriously entertained by any really intelligent person.—James R. Angell, president of Yale University.

I take it for granted that the introducer of the bill is in close communion with the rulers of Soviet Russia, since he is faithfully reproducing one of their fundamental policies. Truly we are getting on.—Nicholas Murray Butler, president of Columbia University.

In the name of two hundred and fifty colleges and universities located in forty-two states we pray Kentucky will not commit intellectual suicide by prohibiting the teaching of evolution or the use of books favoring evolution.''—Robert L. Kelly, executive secretary, Association of American Colleges, New York.

Any attempt to impose legislative restrictions on the teachers of science is contrary to all the principles on which the American Republic has been founded.—Charles S. MacFarland, general secretary Federal Council of the Churches of Christ in America, New York.

## CARDINAL DOUGHERTY ON VIVISECTION

CARDINAL DOUGHERTY, of Philadelphia, under date of December 30, 1921, addressed the following letter to the Society for the Protection of Scientific Research:

Having been asked to give an expression of opinion on the subject of vivisection, I deem it needless to say that, with you and all others opposed to cruelty of whatever kind, I deplore any abuse of vivisection that may cause unnecessary pain to lower animals.

But as actually conducted for the advancement of medical research, vivisection seems to me not only unobjectionable, but even praiseworthy. Scientifically carried out, it is, as you know better than I, almost entirely confined to the inoculation of mice, rats, guinea pigs and rabbits, and is much less frequently practiced on cats, dogs, horses and other higher species of brute animals. Since the invention of anesthetics, and with the use of antiseptic methods, it has become practically painless. Animals used for experimental purposes are well fed and sheltered, and in many respects are better off than those in a state of nature or in subjection to work. They escape the rapacity of fiercer and larger animals, the ill-usage of sport, the drudgery of toil, exposure to the heat and cold of the seasons, and the cruelties of keepers, drivers and exploiters.

According to the law of nature, the lower species of creatures exist for the higher. The clod of earth supports the plant. The vegetable kingdom supplies the wants of the animal. The brute animal and all other inferior things are for the good of man, who was made directly for the glory of God. Man, then, may use all inferior things for his own benefit.

We exterminate vermin and insects, roaches, mice, rats and serpents, for the sake of health, cleanliness and comfort. The children in our schools are taught to combat the plague of flies as carriers of noxious microbes. We kill animals, fowls and fish for our food. Fishermen bait fish with live worms.

If, then, to preserve or restore health, to prolong life, and even to seek pleasure, it is permissible to inflict pain and death upon inferior forms of animal life, why may not the scientific man, for the common good, experiment on lower animals, especially when he takes every precaution against unwarranted infliction of pain by the use of anesthetics and by antiseptic methods?

Animals, themselves, owe to vivisection a great debt. Epizootic diseases, like anthrax, swine-fever, chicken cholera, silk-worm disease, cattle tuberculosis, which, in the past, caused untold suffering to animals, and every year killed them by millions, have been brought under control by the experiments of vivisection.

But man is the chief beneficiary. For it has been mainly owing to these experiments that great discoveries have taken place regarding the nervous system, bone growth, the blood, digestion, infections, serums, antitoxins and vaccinations; and without vivisection little or no progress would have been made in physiology, pathology, bacteriology and therapeutics.

To forbid vivisection would be to hamper science, do a mischief to the human race and foster misplaced sympathy.

## SCIENTIFIC NOTES AND NEWS

A SUMMER meeting of the American Association for the Advancement of Science will, by recent vote of the executive committee of the council, be held at Salt Lake City from June 22 to 24, in conjunction with the annual

meeting of the Pacific Division of the association. Arrangements for the meeting are in charge of Mr. W. W. Sargeant, secretary of the Pacific Division. All members of the association and of the associated societies are invited to be present, and all associated societies are invited to hold sessions. Sections of the association are also invited to hold sessions, but no attempt will be made to have all sections represented on the program of the meeting. Information regarding this summer meeting will be published in Science from time to time as the preparations mature.

The Norman Bridge Laboratory of Physics of the California Institute of Technology was dedicated on January 28. In the afternoon, Dr. Robert A. Millikan, director of the laboratory, was introduced by Dr. A. A. Noyes, and gave an address on "Recent research work on the extension of the ultra violet spectrum and the insight it affords into the nature of matter." In the evening, the laboratory was presented by the donor and accepted by Dr. Millikan on behalf of the institute. There were brief addresses by Mr. Henry M. Robinson, vice-president of the board of directors; George E. Hale, director of the Mount Wilson Observatory, and Dr. H. A. Lorentz, professor of mathematical physics at the University of Leiden. Then followed a reception in honor of Dr. and Mrs. Millikan and Dr. and Mrs. Bridge.

Sir David Prain is about to retire, under the age rule, from the directorship of the Royal Botanic Gardens, Kew, which he has held since 1905. He will be succeeded by Dr. A. W. Hill, who has been assistant director since 1907. Dr. Hill, before his appointment to Kew, was lecturer in botany in the University of Cambridge, of which he is a graduate.

The gold medal of the Royal Astronomical Society has been awarded to Dr. J. H. Jeans for his contributions to theories of cosmogony.

At a recent meeting of the Paris Academy of Medicine the election of new officers for 1922 resulted as follows: Professor Béhal, the vice-president for 1921, succeeded, in accordance with the provisions of the constitution, to the presidency. Dr. Chauffard, professor of clinical medicine in the University of Paris, was elected vice-president (president for 1923). Dr. Souques was reelected annual secretary.

Dr. Henry Chandler Cowles, professor of plant ecology at the University of Chicago, has been elected president of the Chicago Academy of Sciences.

The American Phytopathological Society, meeting at Toronto December 27 to 31, elected as president Dr. E. C. Stakman, of the University of Minnesota; as vice-president, Dr. N. J. Giddings, of the University of West Virginia; and as secretary-treasurer, Dr. G. R. Lyman, of the U. S. Department of Agriculture, Washington, D. C. Dr. H. B. Humphrey, of the U. S. Department of Agriculture, was elected councillor for one year, and Dr. I. E. Melhus, of the Iowa Agricultural College, for two years.

Charles W. Price, who has retired as editor of the *Electrical Review* after nearly forty years of service, was the guest of honor at a luncheon given by a number of his friends in the electrical industry on January 18, at the Lotos Club in New York.

Dr. Frederick L. Hoffman, of the Prudential Insurance Company, has been elected a member of the Royal Institute of Public Health.

Professor Filibert Roth, head of the Department of Forestry of the University of Michigan, was appointed chairman of the Permanent Timber Supply Committee at the National Agricultural Conference held in Washington, D. C., from January 24 to 27.

According to the *Journal* of the American Medical Association, it is reported that Dr. Hubert Work, president of the American Medical Association and now first assistant postmaster general, may be named postmaster general to succeed Will H. Hays, who is to resign to become the head of the motion picture industry of the country.

Dr. E. W. Dean, long connected with the Bureau of Mines as petroleum technologist, has resigned to accept the position of assistant

to Roger Chew, inspection department, Standard Oil Company of New Jersey. He will be succeeded in his position at the Pittsburgh Station by N. A. C. Smith of the Washington, D. C., laboratory. F. W. Lane, organic chemist at Pittsburgh, will succeed Mr. Smith.

Dr. H. W. Dye has resigned as assistant professor of plant pathology, Cornell University, to become chief pathologist of the research department, Dosch Chemical Company, Louisville, Ky., manufacturers of insecticide materials and appliances. Dr. G. E. Sanders also joins the research department of this company, having resigned as chief of insecticide investigations of the Canadian Department of Agriculture.

Dr. H. H. Morris, formerly in the chemical department of E. I. du Pont de Nemours and Company, is now director of the research department of the Bond Manufacturing Corporation, Wilmington, Del.

Louis E. Saunders has been appointed director of the research department of Norton Company, Worcester, Mass.

Sten De Geer, acting professor and chairman of the Geografiska Institutet, University of Stockholm, is to give two courses at the University of Chicago during the coming Summer Quarter. One course will deal with the geography of the Scandinavian countries, while the other involves a survey from the standpoint of political and economic geography of the "New Europe."

Emile F. Gautier, professor of geography in the University of Algiers, has arrived in Cambridge to take up his work as French exchange professor at Harvard University for the second half of the current year. Professor Gautier will give a half course on the geography of Northern Africa and the Near East, which will be open both to graduate students and undergraduates and a research course primarily for graduates.

Dr. Christen Lundsgaard, formerly of the faculty of the University of Copenhagen, has arrived in the United States to become associated with the Rockefeller Institute for the next two years. He will conduct research work in diseases of the heart and on pneumonia.

Charles E. Simon, of the department of medical zoology, School of Hygiene and Public Health, Johns Hopkins University, has been appointed a delegate from this school to the Second International Congress of Comparative Pathology, to be held at Rome on September 20.

Three members of the staff of the Rockefeller Institute, Dr. Paulo Provença, Dr. Frederick Russell and Dr. Richard M. Pearce, sailed February 2, for Sao Paulo, Brazil, where they will consult Dr. Carlos Chagas of the Brazilian Department of Health upon the care and treatment of tropical diseases.

Dr. Charles P. Berkey, professor of geology at Columbia University, has been given leave of absence to accompany an expedition for research work in Mongolia, which is being financed by the American Museum of Natural History and by the magazine, *Asia*.

Dr. Robert S. Platt, of the department of geography at the University of Chicago, is now in Porto Rico in connection with a study of the economic geography of Middle America. The other places to be visited include several of the islands of the West Indies and parts of Mexico, Central America, and the Carribean coast of South America. Dr. Platt is accompanied by Harold S. Kemp, a student in the geography department and for a time secretary to the Geographic Society of Chicago.

A message has been received at Ottawa through Canadian customs officials under date of November 18 last, from a manager of a Hudson Bay post, stating that Donald B. MacMillan was spending the winter at Nauwatta, eighty miles north of Cape Dorset.

The Middleton Goldsmith lecture of the New York Pathological Society was delivered at the New York Academy of Medicine on February 3, by Professor Thomas Hunt Morgan, of Columbia University, the subject being "Some Possible Bearings of Genetics on Pathology."

THE Joseph Leidy memorial lecture in science at the University of Pennsylvania was given by Dr. William Bateson, director of the John Innes Horticultural Institute, Merton Park, London, on January 24. Dr. Bateson's subject was "The segregation of genetic types."

DR. FRANCIS G. BENEDICT, director of the Nutrition Laboratory of the Carnegie Institution of Washington, lectured at Pennsylvania State College under the auspices of the Institute of Animal Nutrition and the Department of Agricultural Chemistry on the subject "Calories for children," on January 26.

DR. CHARLES WARDELL STILES, professor of medical zoology at the Hygienic Laboratory, Washington, D. C., has completed a series of lectures on nomenclature in medical zoology at the School of Hygiene and Public Health of the Johns Hopkins University, under the auspices of the department of medical zoology.

ON February 3 Professor C. J. Keyser made an address before the Philadelphia Section of the Association of Teachers of Mathematics of the Middle States and Maryland on "The mathematical obligations of philosophy and education." On January 14 he spoke before the New York Schoolmasters' Club on "A new conception of the nature of man and its bearings on education."

AT a meeting of the Royal Institution held on January 20, Sir James Dewar delivered a lecture on "Soap films and molecular forces."

PROFESSOR J. A. FLEMING will deliver a lecture on February 21 before the Institution of Electrical Engineers on "Michael Faraday and the foundations of electrical engineering."

DR. C. E. KENNETH MEES, director of research and development, Eastman Kodak Company, gave several lectures in Montreal and Toronto during the last week in February. On February 20 at Montreal he spoke before the Canadian Club on "The road to wealth." The same evening he lectured before the Montreal Section of the Society of Chemical Industry on "Chemistry and the motion picture." At Toronto he gave the following lectures February 21, "Photography through the microscope," before the Camera Club; February 22, "Chemistry and the motion picture," before the Toronto Section of the Society of Chemical Industry; February 23, "The getting of wisdom," before the Empire Club, and "A hundred years hence," before the Canada First League.

ACCORDING to *Nature* the officers of the Ramsay Memorial Fund announce that the dean and chapter of Westminster have consented that a tablet containing a medallion portrait of Sir William Ramsay should be placed in Westminster Abbey in the place immediately below that occupied by the Hooker tablet. The tablet is being executed by Mr. Charles Hartwell, A.R.A. It is anticipated that the unveiling will take place in October next. At the request of the Ramsay Memorial Committee a commemorative medal of the late Sir William Ramsay has been executed by the French sculptor, M. Louis Bottée. The medals will be struck in London when it is known approximately how many copies will be required.

DR. CHARLES BASKERVILLE, director of the chemical laboratories of the College of the City of New York, died of pneumonia at his home on Jaunary 28, at the age of fifty-two.

MR. WILLIAM T. CARRIGAN, one of the senior assistants in the Nautical Almanac Office, U. S. Naval Observatory, died at Washington, D. C., on January 20, 1922. Mr. Carrigan entered the Nautical Almanac Office in March, 1901.

SIR ERNEST HENRY SHACKLETON, the British explorer, died from heart disease on January 5 on board the steamship Quest. Captain L. Hussey will accompany the body to England. Professor Gruvel and the other members of the party will continue the expedition.

FATHER GUISEPPE LAIS, vice-director of the Vatican Observatory, has died at the age of seventy-six years.

THE death is announced in *Nature* of two distinguished English engineers—Dr. Edward Hopkinson, who like his brother, John Hopkinson, was a leader in electrical engineering,

and Sir William Matthews, past president of the British Institution of Civil Engineers.

THE death is reported of Senator Ciamician, professor of chemistry at Bologna.

CORRECTING a recent note in SCIENCE, the schedule of meetings of the American Astronomical Society is as follows: September, 1922, Yerkes Observatory; December, 1922, Cambridge and Boston; September, 1923, Mt. Wilson Observatory; December, 1923, Vassar College.

NINE British and American scientists, members of the expedition to the Andes Mountains to make a study of the physiological changes which enable people to live permanently at high altitudes, returned on February 1. The expedition was under the leadership of Joseph Barcroft of Cambridge University. Its membership included Dr. Alfred C. Redfield, assistant professor of physiology at the Harvard Medical School; Dr. C. A. L. Binger of the Rockefeller Institute, New York; Dr. George Harrop of the Presbyterian Hospital, New York; Dr. A. V. Bock of the Massachusetts General Hospital; Dr. Henry S. Forbes, of Harvard University; Dr. J. G. Meakins, of Edinburgh University, and Dr. J. H. Doggart of King's College, Cambridge. Professor Barcroft is now giving in Boston a course of Lowell lectures on the work of the expedition.

AT the convention of the New York City Federation of Women's Clubs, held in New York City on February 3, a resolution was introduced by Mrs. Belle de Rivera endorsing a bill now before the legislature prohibiting the use of dogs for vivisection. There were about two thousand members in attendance and, according to the daily press, the motion was "overwhelmingly defeated."

THE late George R. White, president of the Potter Drug and Chemical Corporation, has bequeathed to the city of Boston a fund of more than $5,000,000, the income of which is to be used for creating works of public utility and beauty. Two of the three objects specified by Mr. White are a zoological garden and an aquarium. Other bequests in Mr. White's will are $100,000 each to the Children's Hospital, the Museum of Fine Arts and the Massachusetts General Hospital. The Massachusetts Hospital also is given a similar sum for the special purpose of treatment of diseases of the skin. Previous to his death Mr. White had given $1,000,000 for a new building and endowment for the Massachusetts College of Pharmacy.

IT is announced from Montreal that instead of converting the $100,000 prize he has offered for a cancer cure into a fund for cancer research work, as he had been urged, Lord Atholstan has given a second $100,000 for research.

THE fortieth course of popular medical lectures will be given under the auspices of the Stanford Medical School on alternate Friday evenings, as follows: January 13, The Basis of Modern Medicine: Dr. William Ophüls. January 27, The Attitude of the Public Toward the Blind: Miss Katherine Foley. February 10, The Treatement of Deformities Following Infantile Paralysis: Dr. Arthur L. Fisher. February 24, The Control of Botulism: Dr. E. C. Dickson. March 10, The Truth About Vivisection: Mr. Ernest H. Baynes. March 24, Present Day Methods of X-Ray Diagnosis: Dr. W. Edward Chamberlain.

THE city of Paris has authorized the expenditure of 2,500,000 francs ($183,750 at present rate of exchange) for the purchase of radium to be used in the public hospitals for the cure of cancer.

## UNIVERSITY AND EDUCATIONAL NOTES

APPROPRIATIONS of $18,210,353 for colleges and universities, $12,029,513 for medical schools, and $646,000 for negro education were made during the last fiscal year by the General Education Board, founded by John D. Rockefeller, according to the report for 1920-21. The total appropriations of the board from its foundation in 1902 to June 30, 1921, have amounted to $89,017,872. Of the gift of $50,000,000 made by Mr. Rockefeller in 1919 for teachers' salaries, appropriations were

made up to July 1, 1921, which amounted to $26,732,000, which was distributed among 191 different institutions. The annual report further reveals that Mr. Rockefeller has released the board from any obligation to hold any of his gifts in perpetuity.

THE will of the late A. Barton Hepburn, of New York City, gives $250,000 to the A. Barton Hepburn Hospital at Ogdensburg, N. Y.; $200,000 to Middlebury College in Middlebury, Vt., of which Mr. Hepburn was a graduate; $150,000 to Columbia University, of which he was a trustee, and $100,000 to St. Lawrence University at Canton, N. Y., where he had lived. The will had also given $100,000 each to Wellesley College, of which his daughters were graduates, and to Williams College, of which his son was a graduate, but these gifts were canceled by a codicil because he made gifts to those institutions two years ago, anticipating the intention of his will. Each gift to educational institutions is specifically made for the purpose of founding chairs in economics or history.

MR. WILLIAM COOPER PROCTOR has endowed three visiting fellowships at Princeton University with an annual stipend of $2,000. The fellows are to be appointed, respectively, on nomination of the University of Oxford, the University of Cambridge and the Paris Higher Normal School.

DR. M. C. MERRILL, head of the department of horticulture at the Utah Agricultural College and horticulturist at the Agricultural Experiment Station, has accepted an appointment as dean of the College of Applied Arts and as head of the department of horticulture of the Brigham Young University. This appointment is to take effect July 1.

H. M. JENNISON, assistant professor of botany and bacteriology at the Montana State College, has been granted leave of absence and will spend the remainder of the college year in the graduate laboratories of the Missouri Botanical Garden and Washington University, St. Louis.

ALFRED P. LOTHROP is on leave of absence from the chair of organic chemistry at the Medical School, Queen's University, Kingston, Ontario, where he has taught for the past twelve years, to act as associate professor of chemistry at Oberlin College.

## DISCUSSION AND CORRESPONDENCE

### PROFESSOR SUDHOFF'S PARACELSUS

THE announcement of the forthcoming publication of the complete works of Paracelsus, under the editorship of Professor Karl Sudhoff, of Leipzig, will be a matter of considerable interest to chemists and physicians as well as to philosophers. This edition will include the unprinted MS. material as well as what is already known in the printed texts. Paracelsus was a most prolific writer, but many of his more important works, familiar to bibliophiles by their characteristic title-pages in red and black, are now so rare as to be practically inaccessible, particularly such pamphlets as those on miners' diseases (1567) and mineral baths (1576).

Paracelsus, one of the pioneers in analytical chemistry, the founder of chemotherapy, and one of the great medical reformers of the sixteenth century, was even a doughtier figure than Vesalius, who began bravely but ended as a courtier, or Paré, whose popularity saved him from persecution. As compared with these men, Paracelsus occupies about the same position in medicine as did Luther or Knox in relation to Erasmus or Maitland of Lethington. He was more impulsive and impetuous and pushed his denunciation of scholastic medicine to the extreme limit of coarseness. His training was, however, better than is commonly supposed. As Sudhoff has shown, he graduated at Ferrara in 1515, having studied under the celebrated Leonicenus. Although Browning's poem idealizes him, he is commonly represented as a charlatan and a mountebank. This false view is, in the main, due to the character of his writings, which are a curious jumble of exaggerated swagger and of passages showing keen insight into the real nature of things, *e. g.*, that gout and calculus are diathetic diseases, or that goitre and myxœdema are hereditary

and interrelated. His literary style is turgid, verbose, obscure, but this is a necessary and sufficient reason for a modern edition, with the proper *apparatus criticus* of interpretative notes.

Of the extraordinary fitness of the editor for his task, it is almost unnecessary to speak. A brilliant Goethe scholar and *Goetheforscher* in his youth, Sudhoff is known to physicians as the Paracelsus scholar *par excellence*. His whole life of investigation at the Institute of Medical History at Leipzig, his vast researches in medieval medicine, have been nothing else than preliminary to this work, which (at the age of 68) he regards as his swan-song.

Professor Sudhoff's plan is to issue the work in fifteen volumes, containing all the MS. material, and to be sold by subscription at a flat rate per volume. Librarians and scientific men may obtain further details by writing to Professor Karl Sudhoff, Institut für Geschichte der Medizin (38 Talstrasse), Leipzig, Germany.

F. H. GARRISON

## THE VALUE OF TILTH IN AGRICULTURE

THE remarks of Mr. L. S. Frierson relative to the above question (SCIENCE, September 2, 1921, p. 193) have just come to my attention. Bechhold's work, which I quoted (SCIENCE, July 22, 1921, p. 74), indicates that evaporation draws salts toward the surface; but rain rather than light cultivation is the main factor returning them toward the roots, although of course cultivation helps.

An essential in cultivation is the breaking of the surface crust or skin, and Mr. Frierson says that, contrary to my hypothesis, this comminution of the upper surrface of the soil "more or less perfectly *stops evaporation, and thus conserves the store of soil water.*"

This claim of Mr. Frierson is quite contrary to all engineering and practical experience. The way to dry wet clothes is not to roll them up, but to spread them out and expose a large surface to the air. The breaking of a crust or skin, with increased exposure of fresh surfaces causes, or tends to cause, *increased* evaporation. Indeed Bechhold says that the cooling effect of talcum and similar dusting powders is consequent upon the fact that they give the skin more free surface for evaporation.

Unless direct experimental evidence to the contrary is produced, I must maintain my view that cultivation, by increasing surface evaporation, tends to bring upward subsurface water and salts, and thus aid plants in dry weather.

JEROME ALEXANDER

NEW YORK, JANUARY 7, 1922

## CASTS OF FOSSIL VERTEBRATES AT STUTTGART

TO THE EDITOR OF SCIENCE: The director of the Stuttgart Museum (Württemburgische Naturalien Kabinett) in Germany has offered for sale a series of casts of fossil vertebrates from originals in that museum. Most of these are of great teaching and exhibition value, and owing to exchange and economic conditions in Germany, the prices are extremely low. The American Museum has purchased the series and received the shipment in excellent condition. The quality of the casts varies, some are excellent, others only fair, but I desire to call attention of those who are interested to the opportunity both to secure some very useful casts at small expense and to aid in continuing the work of one of the leading paleontological museums of Germany. For information write to Dr. Martin Schmidt, director of the Stuttgart museum.

W. D. MATTHEW

## THE RAY SOCIETY

TO THE EDITOR OF SCIENCE: May I be permitted to express the thanks of the Council of the Ray Society to Professor G. H. Parker for his timely letter published in SCIENCE of November 25, 1921? I should like also to take this opportunity of apologizing to our American subscribers for the continued delay in the issue of our publications, a delay which is due entirely to the difficulty of executing the elaborate colored plates for Prof. W. C. McIntosh's "British Marine Annelids." The first part of the fourth (and final) volume of this work will form the issue to subscribers for 1920 and will, it is hoped, be ready within the next few months. The second part, completing the work, is already in hand and will form the issue for 1921. Subscriptions for each of these

years can still be received up to the date of publication.

W. T. Calman,
*Secretary of the Ray Society*

1, Mount Park Crescent,
Ealing, London, W. 5,

## QUOTATIONS

### THE NEW CHEMISTRY

The service, at once scientific and humanitarian, of Dr. Charles Baskerville, who died last week, is illustrative of what the science of chemistry is undertaking for the alleviation of human suffering. Dr. Baskerville's special researches had to do with the causes and prevention of occupational diseases and with the purifying of ether as an anesthetic. These are, however, but suggestive of the innumerable researches in which his brother chemists of every land in this new age of their science are seeking not only to heighten industrial productivity, but to promote and conserve the health and strength of human bodies.

During the war, when it became necessary to use poison gas to fight poison gas, the ablest American research chemists were called to the country's defense. The recent action of the Washington conference gives hope that choking and wasting vapors will not again sweep over fields or stain the skies, and that such another service as these chemists were called upon to give will never again be asked of a benign science that will now have freedom to devote its entire attention to benefiting men, women and children.

That this is more than a vague, visionary hope is intimated by the recent report of a committee of the American Chemical Society, under the chairmanship of Dr. Charles H. Herty. It is a clarion summoning of the chemists to come to the battle against disease. In the war the development of means of defense was not left to haphazard discoveries by isolated chemists. The best-trained workers in systematic research were brought together and were kept in daily—almost hourly—conference, where they were joined by pharmacologists and experimental pathologists, until the problems upon which the fate of nations depended were solved. But while war claimed its sacrifice in millions of lives, "disease each year claims its tens of millions." The new problems give this science a more urgent, poignant call. And the committee, contemplating the ravage of disease, puts this question: "Can we not bring to these problems the same methods so successfully employed in the solution of the means of making war?"

Several centuries ago the chemist and the physician cooperated. Then they separated, the chemist turning toward industrial production. Now it is being realized that, though the bacteriologists and pathologists have accomplished wonders, they have "definitely reached a point where they must turn to the chemists for the solution of many of their most important problems." Not only are the chemists' medicaments needed for the cure or alleviation of certain specific diseases, but their advice is needed as to the acceleration or retardation of chemical reactions that take place in the body. The myriad battles with avoidable or preventable disease there go daily on. The lesson of the war intimates what victories may be expected in these battles from the cooperation, under ideal conditions of time and research, on the part of those whose science touches these very issues of life.

Dr. Baskerville, not only by his own researches, but also and especially by developing and equipping what was perhaps the best series of chemical laboratories in the United States and by organizing a department which has given tuition to hundreds of young men for service in this science, made his lasting contribution, though his studies and researches and teaching here are over. It will be remembered, however, that but a few weeks before his death, after years of intimate study of the atom, he said that "there is something that cannot be explained on a purely materialistic hypothesis." So the quest goes on.—The New York *Times*.

## SPECIAL ARTICLES

### A CONVENIENT METHOD OF DETERMINING THE BRIGHTNESS OF LUMINESCENCE

Having recently had occasion to measure the brightness of various fluorescent substances I tried out for this purpose an optical pyrometer.

The instrument was of the type based upon the well known "thermo-gauge" devised by the late E. F. Morse for controlling the temperature to which metals are heated in tempering. It consists of a telescope of short focus, low power and relatively large aperture, having a tungsten lamp in the focal plane. The filament of this lamp is superimposed upon the image of the surface the brightness of which is to be measured. With a screen in the eye piece so selected as to give a fair color match with a minimum of absorption it is easy to adjust the current through the lamp until the filament merges in the surface with which it is to be compared. The lamp may be compared for temperature as in ordinary optical pyrometry or directly for brightness, using an illuminated matte surface subject to known fluxes of light.

While this scheme becomes rigorous only in the comparison of non-selective radiation, the departures are not troublesome. Nearly all fluorescence colors, on account of the broad-banded character of their spectra, may be regarded as modified whites. They are in general of diluted rather than of saturated hue. Again, in dealing with very low intensities, as in the study of luminescence, slight color differences become quite inappreciable. All that is demanded of the color screen is to give a ruddy, greenish or bluish tone respectively so as to avoid strong contrasts.

Fortunately, as in all photometric processes involving the distinguishing of a pattern, the sensibility of the determination does not fall off seriously with the diminution of the field of view until it becomes difficult to distinguish outlines.

With this apparatus the breaking down occurs at very low intensities. Any surface against which the unlighted filament can be seen as a black line can be measured as to brightness with surprising consistency. In searching for a white surface devoid of luminescence, for example, it was easy to detect traces of fluorescence in a variety of substances usually deemed inactive. Thus Becquerel,[1] more than sixty years ago, noted that viewed in his phosphoroscope nearly everything non-metallic glowed. The only point here is that by this simple method these traces are found to be measurable.

[1] Becquerel: La Lumière, Vol. 1, p. 256.

Because of its availability at very low intensities this instrument is likewise adapted to the determination of persistent phosphorescence. One has only to find a suitable screen, focus the pyrometer on the phosphorescent body, note the cessation of excitation on a chronograph and record thereafter the times at which the phosphorescence matches the filament which is set successively to a diminishing series of predetermined brightnesses.

The accompanying table gives estimates of the brightness of a number of fluorescent materials determined in this way. The excitation was approximately the same for all, excepting in the case of luciferin. For a sample of this interesting substance, made from marine light-giving organisms, I am indebted to Professor E. N. Harvey. The luciferin was activated by wetting the powdered material and stirring vigorously to hasten oxidation. In all other cases an iron spark was used at a distance of about ten centimeters. The spark was obtained by means of the convenient step up transformer designed by Mr. W. C. Andrews for that purpose.

THE BRIGHTNESS OF FLUORESCENT SUBSTANCES

| SUBSTANCES | BRIGHTNESS IN MILLILAMBERTS |
|---|---|
| Dyestuffs in dilute solution: | |
| Rhodamin 6 G | 4.2 to 12.0 m. l. |
| Rhodamin B | 5.2 |
| Fluorscein | 4.2 to 5.2 |
| Tetrachoreosin | 4.2 |
| Resorufin | 3.0 |
| Luciferin (prepared by Professor Harvey) | 14.5 to 16.0 |
| Uranyl salts (solid): | |
| Potassium uranyl sulphate | 35.2 |
| Ammonium uranyl sulphate | 23.0 |
| Rubidium uranyl chloride | 8.11 |
| Potassium uranyl nitrate | 7.53 |
| Uranyl nitrate | 6.61 |
| Cæsium uranyl nitrate | 5.71 |
| Uranyl acetate | 5.39 |
| Potassium uranyl fluoride | 4.69 |
| Cæsium uranyl acetate | 4.56 |
| Lead uranyl acetate | 3.75 |
| Miscellaneous solids: | |
| Synthetic willemites | 12.5 to 14.0 |
| Natural willemite (Franklin Furnace) | 5.31 |
| Sidot Blendes | 3.08 to 10.9 |

| | |
|---|---|
| Calcium sulphide (Balmain) | 1.26 |
| Canary glass | 7.31 |
| Calcite (red) from Langban | 0.132 |
| Cadmium phosphate (red).... | 0.0182 |

Since to most of us the millilambert conveys no very definite meaning in terms of a familiar visual sensation, I may add that according to the measurements of Coblentz a tungsten filament at 2000° C., which is not far from the temperature of our ordinary incandescent lamps of the vacuum type, has a brightness of *630,000 millilamberts.*

Since our various fluorescent substances vary in color it should be further stated that the brightness in each case is such that the intensity of the maximum region in the fluorescent band equals the brightness of the corresponding region in the spectrum of a neutral matte surface of the specified number of millilamberts.

In general, according to these measurements our known luminescent materials are of the order of a few millionths in brightness compared with an illuminant such as the ordinary electric lamp.

E. L. NICHOLS

PHYSICAL LABORATORY
OF CORNELL UNIVERSITY,
DECEMBER, 1921

## THE AMERICAN SOCIETY OF ZOOLOGISTS

THE American Society of Zoologists held its nineteenth annual meeting at the University of Toronto in conjunction with Section F of the American Association and in association with other biological societies on December 28, 29 and 30, 1921. President C. A. Kofold and Vice-president A. L. Treadwell presided at the various sessions.

William Bateson, director of the John Innes Horticultural Institution, Merton Park, Surrey, England, was elected honorary fellow of the society.

The following were elected to membership:

Edward F. Adolph, University of Pittsburgh; Charles P. Alexander, University of Illinois; William R. Allen, University of Akron; Horace B. Baker, University of Pennsylvania; Frank N. Blanchard, University of Michigan; Joseph H. Bodine, University of Pennsylvania; Robert H. Bowen, Columbia University; Alfred E. Cameron, University of Saskatchewan; William H. Cole, Lake Forest College; Mary E. Collett, University of Buffalo; Rheinart P. Cowles, Johns Hopkins University; Alden B. Dawson, Loyola University Medical School; Hoyt S. Hopkins, Baylor Medical College; Carl L. Hubbs, University of Michigan; George W. Hunter, Knox College; Donald E. Lancefield, University of Oregon; James W. MacArthur, University of Toronto; Robert S. McEwen, Oberlin College; Peter W. Okelberg, University of Michigan; Charles L. Parmenter, University of Pennsylvania; Mary E. Pinney, Lake Erie College; Franklin P. Reagan, University of California; Robert C. Rhodes, Emory University; Franz Schrader, Bryn Mawr College; Gotthold Steiner, University of Berne; Horace W. Stunkard, New York University; Tage Ellinger, University of Illinois; Lewis H. Weed, Johns Hopkins University; Alvalyn E. Woodward, Amherst College; Benjamin P. Young, Cornell University; Hachiro Yuasa, University of Illinois.

After the election the membership roll of the society contained 357 names of members in good standing.

The report of the treasurer showed a probable balance for January 1, 1922, of $808.20, a loss for the year of $81.71, although there are fewer members in arrears than at any time in the last four years. The attention of the society was called to the fact that the present plan of operating on a basis of fifty cents per member per year must in time deplete the accumulated surplus of the society.

The constitution and by-laws were amended to permit the separation of the office of secretary-treasurer.

The nominating committee, composed of M. F. Guyer, S. J. Holmes and J. H. Gerould, reported the following nominations:

President—H. H. Wilder.

Vice-President—B. M. Allen.

Secretary—W. C. Allee.

Treasurer—D. H. Tennent.

Member of the Executive Committee—C. A. Kofoid.

Member of the National Research Council—H. S. Jennings.

Three associate editors of the *Journal of Morphology*—L. L. Woodruff, G. A. Drew and H. V. Neal.

Membership in Council of the American Association for the Advancement of Science—Charles Zeleny and H. E. Crampton.

No other nominations were presented and these men were duly elected.

The executive committee announced the appointment of Aaron L. Treadwell and A. A. Schaeffer as members of the advisory board for the ensuing four years. The other members of this board are: To serve one year, M. M. Metcalf and Gary N. Calkins; to serve two years, William E. Castle and F. R. Lillie; to serve three years, C. A. Kofoid and D. H. Tennent.

S. I. Kornhauser, who has been representing the society in cooperation with a committee from the American Bacteriological Society, in an attempt to standardize American dyes for biological purposes, requested members to forward any information at their disposal concerning the comparative merits of American and imported dyes. He has on hand a considerable amount of information regarding American dyes which is available for any one interested.

The society approved the resolutions adopted by an intersociety conference called at Toronto by the Division of Biology and Agriculture of the National Research Council as a result of a request from representatives of the Botanical Society of America, the American Society of Naturalists and the American Society of Zoologists.

These resolutions call for the appointing of the presidents and secretaries of the societies concerned as an intersociety council to whom shall be referred matters of common interest and who shall study plans for and report a possible constitution of a proposed federation of American biological societies.

As a result of many conferences among those interested the following action was taken creating a Section on Genetics in the society:

*Moved*, That authorization be given for the formation of a Genetics Section of the American Society of Zoologists to cooperate with a similar section established in the Botanical Society of America.

It shall be understood that any member of the American Society of Zoologists may become a member of the Genetics Section by indication of his desire to that effect.

Any member of the society submitting a paper on genetics has the right to have it included in the program of the Genetics Section.

The Genetics Section may designate one of its members as a consulting member of the executive committee of the American Society of Zoologists.

The Section was duly organized.

After considerable discussion, the parasitologists assembled at Toronto decided not to organize a section at present, but appointed Charles A. Kofold their representative, with B. M. Ransom alternate, to attend the proposed conference on the organization of a biological federation and to urgently request the conference to arrange that there could be membership in the proposed Section of Parasitology of men not eligible at present for membership in the American Society of Zoologists.

A communication was received from the Ecological Society of America asking for financial aid in classifying the degree of modification from primeval conditions of the animal life in the different national, state and local preserved areas. Twenty-five dollars was voted for this purpose.

GENERAL RESOLUTIONS

The following resolution was adopted and ordered sent to the appropriate officials:

The American Society of Zoologists, understanding that there is a temporary suspension of certain scientific publications of the U. S. government, including the *Journal of Agricultural Research*, the *Experiment Station Record* and the *Monthly Weather Reports*, desires to put on record its very high appreciation of these journals and of their great national and international importance in the field of natural science and would respectfully urge their resumption at as early a date as possible.

The following resolution was adopted:

*Resolved*, That the secretary express to the president of the University of Toronto and the local committee on arrangements the high appreciation of the American Society of Zoologists for the splendid facilities afforded this meeting and for the cordial hospitality shown the members attending.

The sessions for the prsentation and discussion of papers were better attended than usual in spite of the fact that the society frequently met in sections on account of the length of the program. The symposium on "Orthogenesis," the dinner, and the biological smoker, arranged by the zoologists, were particularly well attended. In point of numbers attending, the smoker was one of the outstanding features of the meeting.

The presence of Professor William Bateson gave a cosmopolitan flavor to the international meeting. The invitation to Professor Bateson was initiated by the American Society of Zoologists, and his presence was due to the cooperation of the Society with the American Association.

A full list of titles and abstracts of the papers presented together with a more complete account of the business transacted will appear in the January number of *The Anatomical Record*.

W. C. ALLEE,
*Secretary*.